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USSR EXPERIMENTS WITH NEW CONSTRUCTION MATERIALS

/Numbers in parentheses refer to the appended sources./

One of the cheapest types of raw material for the production of construction materials is slag and ashes, readily available in many plants. This waste material of fuel burning has been subjected to high temperatures and can therefore be used without any further heat treatment.

The Laboratory of Cementing Materials, Kiev Technological Institute of Silicates, found that slag and ashes could be used successfully in the production of cementing materials in Kiev Oblast, which has a shortage of raw material for this purpose.

Peat is used as fuel in many plants, including glass plants. It was determined at the Bucha Glass Plant that peat slag, with the addition of air-slaked lime, can be used to produce a hydraulic cementing material, slag-lime cement type 60-80. After a steaming process, the material solidifies up to 200-250 kilograms per square centimeter. This product can be used with good results in the production of slag blocks and roofing tiles.

Production costs of slag-lime cement are low. The only requirement is a mill for grinding slag with unslaked lime. Instead of unslaked lime one can use press filter impurities, a waste product of sugar refineries.

The possibilities of using slag in the construction materials industry are far reaching. In only five glass plants of Kiev Oblast the daily amount of peat slag obtained is 30-35 tons, and every ton of this material yields 1,300 bricks or 2,000 roofing tiles.

Peat slag is already being used in Kiev Oblast. The Ministry of Construction Materials Industry Ukrainian SSR has suggested that the Kiev Gypsum-Cement Plant produce a trial batch of slag-lime cement.(1)

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The laboratory of the Central Administration of Construction Materials, Ministry of Transportation, has developed a method of producing a new practical building material, slag blocks with an addition of lime.

Production of cementless slag blocks was recently started at the Nizhnedneprovskiy Plant of the Main Administration of Industrial Construction, Ministry of Transportation USSR. Despite a number of unfavorable circumstances, such as the absence of a screen for slag screening, the blocks produced had an average strength of 72 kilograms per square centimeter, which is twice as high as the strength of cement slag blocks. Cementless blocks also have a high degree of frost resistance.

Experiments were made in producing blocks of unscreened slag. It was found that these too had sufficient strength (36-46 kilograms per square centimeter).

Laboratory workers have experimented with a new mixture, containing clay, for cementless blocks. These blocks proved to have exceptional strength (100 kilograms per square centimeter), and their production cost was 15 percent below that of the other blocks.(2)

Structural parts made of iron, reinforced with silicate, such as floor tiles, girders, etc., completely replace similar products made of reinforced concrete. This was proved by experiments made at Kazan' construction projects, where 2,000 cubic meters of reinforced-silicate structures were used.

The Kazan' Silicate Plant of Construction Trust No 14 has mastered the production of this new product. Reinforced-silicate products can be put out by any silicate plant, as they do not require special equipment. The silicate mixture is prepared in the same way as in brick production, and the mechanical properties of silicates (resistance to compression, adhesion to iron) depend largely on the conditions of lime slaking. Tests carried out at the plant by Engineer I. Krasnyy showed that the slaking process should take place with a minimum amount of moisture. Thus, for instance, when using sand with the ordinary 8-percent moisture content, slaking is done without the addition of water. The lime slaked by the sand moisture is transformed into a loose, crumbling mass, which is poured into the mixer by gravity feed. It is then mixed with water until it reaches the proper consistency for filling into casting molds. The molds are so constructed that several construction parts can be filled and opened up at the same time. These molds were also designed by Engineer I. Krasnyy.

The casting of reinforced-silicate parts is not very complicated. The molds are placed on small cars, and after filling with the silicate mixture (when the reinforcing material has been embedded in it) they are placed in the autoclave to be steamed under pressure. The condensation of the mass in the molds is achieved only by vibration (without ramming). The finished product comes out of the autoclave and requires no further processing.

Numerous tests carried out at the plant have shown that the resistance of silicate mass to compression reaches 200 kilograms per square centimeter. Bending tests with girders have shown complete agreement of experimental results with preliminary calculations. The adhesion of silicate to the reinforcing metal proved entirely secure.

Under normal conditions, reinforced-silicate parts have the necessary durability. Their strength increases with time due to the fact that under the influence of carbon dioxide in the air the free lime is transformed into a solid substance, insoluble by water. This property of silicate is confirmed by the practical use of silica bricks.

The cost of reinforced-silicate products is 40 percent below that of similar reinforced-concrete products, because the production of lime and the quarrying of sand are considerably simpler and cheaper than the production of cement and the quarrying and processing of the inactive ingredients contained in concrete. Silicate plants would be in a position to organize production of prefabricated parts, badly needed by construction projects, with a minimum of expense. However, so far production of reinforced-silicate parts has not been organized at any of the silicate plants under the Ministry of Construction Materials Industry RSFSR. The production of this highly efficient construction material should be introduced during 1950.(3)

After many years of research and experiments, a group of workers at the Institute of Glass, under the supervision of Prof R. L. Pevzner, worked out a method of producing a new refractory, "termokorund." The institute laboratory prepared experimental samples which were analyzed and tested. The new refractory has a melting point of 2,025 degrees centigrade. Termokorund is glaze-resistant and less subject to corrosion by sulfate lye than any other refractory. Tests of termokorund at the Chagoda plant showed that it can be used successfully in constructing the upper portions of tank furnaces, replacing Dinas brick and mullite.

Considerable time has elapsed since the tests, but the new refractory has not yet been introduced into the glass industry. Additional practical tests are required. So far nothing has been done to start them.

In October 1948, eight termokorund blocks were delivered for testing to the "Avtosteklo" Plant in Konstantinovka. Five of the blocks were to be used in lining the tank furnace for melting clinker glass. In December, the furnace was repaired but for some reason none of the blocks were used for this purpose.(4)

Among the achievements of the Soviet glass industry is the invention of a new type of heat-insulating and soundproof material, called "foam glass" (penosteklo). I. I. Kitaygorodskiy, professor of the Chemical-Technological Institute imeni Mendeleyev, V. P. Surovtsev, designer of the experimental plant of the Institute of Glass, P. A. Koryagin, shop foreman of the "Avtosteklo" Plant, and A. M. Ponomarenko, former shop foreman of the same plant, were awarded Stalin Prizes for their work in this connection.

Foam glass comes in blocks of a hard porous substance, a cooled glass mass filled with gas. Foam glass has a very light weight by volume; it is a poor heat conductor and has comparatively high mechanical durability. This makes it a valuable construction and insulating material. Foam glass is soundproof as well as water- and frost-resistant. It does not burn or sink in water. It is easy to process and can be colored different shades. This material can be successfully combined with concrete, brick, stone, etc. The excellent qualities of the new material open up numerous possibilities for architects, builders, and decorators.

Foam glass can be used as a wall-filling material in steel structures of tall buildings. This will reduce the weight of the building and lower construction costs of the foundation. The new material can also be used for partition walls and interstory ceilings. A combination of foam glass with concrete, brick, or stone gives excellent results. Experiments have shown that walls built of combination blocks, containing foam glass, are 20 times lighter than brick walls. The cost of one square meter of foam glass concrete is 50 percent or less of the same area of a brick wall.

The high insulating properties of foam glass make it invaluable in building refrigerators. As a soundproof material, foam glass can be very effective in motion picture studios and theaters. It could also be used in machine shops to reduce the noise of machinery. Being water-resistant and unsinkable, it could become a valuable material for life belts and boats. Finally, foam glass has the properties of a good filter.

After the war, production of the new type of glass was entrusted to one of the shops of the "Avtosteklo" Plant in Konstantinovka. The basic problems of the technological process have been successfully solved. Soviet builders in all parts of the country are eager to learn more about this new material and to begin using it in various construction projects.(2)

Waste products of sulfur are being used at the Gaurdak Sulfur Mine, Turkmen SSR, for the production of a new building material, which has already been used in the construction of a school and 26 cottages.(5)

SOURCES

1. Pravda Ukrainy, No 12, 14 Jan 50

2. Promyshlennost' Stroitel'nykh Materialov, No 12, 17 Mar 50

3. Promyshlennost' Stroitel'nykh Materialov, No 5, 27 Jan 50

4. Promyshlennost' Stroitel'nykh Materialov, No 8, 17 Feb 50

5. Pravda Ukrainy, No 21, 25 Jan 50 (reprint from Turkmenskaya Iskra)

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